



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460**

Chemicals: Mineral Acids (see specific chemicals below)

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SUBJECT: Environmental Fate and Effects Review of Mineral Acids as Inert Ingredients in Pesticide Products

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Summary

EFED has reviewed the available data on the expected environmental fate and effects of releasing selected mineral acids and salts (see Table 2 for specific chemicals addressed) into the environment. In general, the constituents of the mineral acids are commonly found in soil and water in the environment suggesting that releasing low levels of these chemicals would not normally be expected to adversely effect wildlife or water resources. Large releases may adversely affect wildlife and water resources either directly or indirectly. Direct effects may result from exceeding toxicity thresholds of specific chemicals. Indirect effects may be manifested through disrupting ecosystems through altering pH or increasing availability of algal nutrients. The mineral acids included in this assessment have a large number of industrial, food, and

pharmacological uses in addition to their uses in pesticide products. Non-pesticide uses of mineral acids included in this assessment are frequently expected to be the dominant source of release into the environment.

Acids and Bases

The following chemicals are considered to be strong enough acids or bases to alter environmental pHs: ammonium hydroxide, calcium hydroxide, hydrochloric acid, phosphoric acid, potassium carbonate, potassium hydroxide, sodium hydroxide, sulfuric acid, sulfurous acid, tetrasodium pyrophosphate, tricalcium phosphate, and trisodium phosphate.

The magnitude of the pH changes, and thus the magnitude of effects, would depend on a number of factors including the amount of material released and the buffering capacity of the exposed soil or water. Normal aquatic pH's range from 5 to 9. The Office of Water recommended water quality criteria for pH are 6.5 to 9 for freshwater and 6.5 to 8.5 for saltwater (USEPA 1999). At higher or lower pH aquatic life is expected to be adversely impacted. In addition, rapid changes in pH can also be detrimental to aquatic life.

The acids and bases included in this assessment are not expected to be persistent in the environment. Instead they are expected to dissociate, react with organic or inorganic materials, and complex with ionic substrates.

Salts Containing Metals

Salts containing metals frequently dissociate in water resulting in a cationic (positively charged) metal in solution. Based on their solubility, the follow metal containing chemicals are expected to dissociate in solution: aluminum sulfate, ferric chloride, ferric sulfate, magnesium carbonate, magnesium chloride, magnesium sulfate, and zinc sulfate. Metal salts with low solubilities which are expected to remain largely intact include: aluminum hydroxide (alum), barium sulfate, and manganese carbonate. Dissociation is frequently dependent on pH, with lower pH's (more acidic conditions) resulting in higher levels of dissociation and greater solubility. Aquatic toxicity of metals is also dependent on water hardness.

Toxicity of metals varies with the species of metal and its concentration. EPA's Office of Water publishes recommended water criteria values based on toxicity of selected chemicals. The following table show available Office of Water's recommended criteria for the metals included in this assessment.

Table 1. Recommended criteria for selected metals in water. From USEPA 1999.

Chemical	Freshwater concentrations µg/L		Saltwater concentrations µg/L		Federal Register Cite/ Source
	CMC ¹	CCC ²	CMC	CCC	
Aluminum (pH 6.5-9.0)	750	87	NA	NA	53FR33178
Iron	NA	1000	NA	NA	EPA Gold Book
Zinc	120	120	90	81	62FR42160 IRIS 10/010/92

¹ Criteria Maximum Concentration (CMC) is the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (1 hour average) (acute);

² Criteria Continuous Concentration (CCC) is the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without deleterious effects (chronic).

USEPA Office of Water recommend a freshwater water quality criteria value of 1 ppm (USEPA 1999) implying relatively low toxicity. Zinc and aluminum have recommended criteria implying these metals are more toxic. Recommended values were not available for magnesium, barium or manganese, however, the chemicals containing barium and manganese possess low solubility, reducing the potential for aquatic exposure.

Since metals are elements they do not degrade and thus are permanent in the environment. Free and soluble metals are likely to dissipate by being sequestered in soil, sediment, and plants.

Nitrogen and Phosphorus Containing Chemicals

The nitrogen and phosphorus chemicals included in this assessment are: ammonium bicarbonate, ammonium chloride, ammonium hydroxide, ammonium nitrate, ammonium polyphosphate, ammonium sulfate, calcium phosphate, diammonium phosphate, disodium phosphate, monoammonium phosphate, phosphoric acid, potassium phosphate, sodium acid pyrophosphate, sodium dihydrogen phosphate, sodium hexametaphosphate, sodium nitrate, sodium nitrite, sodium tripolyphosphate, tetrapotassium pyrophosphate, tetrasodium pyrophosphate, tricalcium phosphate, and trisodium phosphate.

Nitrogen and phosphorus containing chemicals are commonly used as fertilizers. They generally possess relatively low toxicity to terrestrial and aquatic organisms. As nutrients, they can cause increased plant growth which can be detrimental in aquatic ecosystems causing eutrophication. Eutrophication occurs when algae blooms die and are degraded by bacteria which drain oxygen from the water body. With the exception of tricalcium phosphate, all of the phosphorus and nitrogen containing chemicals in this assessment are expected to be highly soluble. Phosphates

despite being highly soluble tend to bind to soil reducing their tendency to overload aquatic systems.

Ultimately, the nitrogen and phosphorus chemicals included in this assessment are expected to be taken up and metabolized by plants to form naturally occurring compounds.

Table 2. Chemical included in this assessment and their properties. The following information was collected from the National Library of Medicine's Hazardous Substance Database (HSDB) (<http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>).

Chemicals	Solubility	pH	Vapor pressure	Uses
Aluminum hydroxide	Low solubility at pH 7	NA	NA	Adsorbent; emulsifier; ion-exchanger, in chromatography; mordant in dyeing; filtering medium; manufacture glass, fire clay, paper, pottery, printing inks, lubricating compositions, detergents; waterproofing fabrics; in antiperspirants, dentifrices; used in pharmacy as the gel or dried gel.
Aluminum sulfate	SOL IN 1 PART WATER	Aq soln (1 g/1 ml water) not less than 2.9	Essentially zero.	Tanning leather, sizing paper, mordant in dyeing; purifying water; manuf lakes, aluminum resinate; fireproofing & waterproofing cloth; clarifying oils & fats; treating sewage; waterproofing concrete; deodorizing & decolorizing petroleum; antiperspirants; agricultural pesticides; manuf of aluminum salts. Food additive.
Ammonium bicarbonate	17.4% at 20 deg C	7.8 (0.1 N)	7.85 kPa (58.9 mm Hg)	In baking powder formulations; in cooling baths; in fire extinguishers; manuf porous plastics, ceramics; manuf dyes, pigments; in compost heaps to accelerate decompn; as fertilizer; for defatting textiles; in cold wave solns; in chrome leather tanning; to remove gypsum from heat exchanges and other processing equipment.
Ammonium chloride	28.3% at 25 deg C	5.5 (1% sol'n)	1 mm Hg	Plant dessicant, cotton defoliant, as flux for coating sheet iron with zinc; tinning; in dry & leclanche batteries; dyeing; freezing mixtures; electroplating; to clean soldering irons; safety explosives; lustering cotton; tanning; in washing powders; manufacturing dyes; in cement for iron pipes; for snow treatment (slows melting on ski slopes); therapeutic: systemic acidifier; vet: expectorant; diaphoretic; acidifying diuretic

Chemicals	Solubility	pH	Vapor pressure	Uses
Ammonium hydroxide	NA	10.6 (0.01 N solution)	2160 mm Hg @ 25 deg C	Textiles; mfr of rayon, rubber; condensation polymerization; pharmaceuticals; ceramics; photography (development of latent images); ammonia soaps; lubricants; fireproofing wood; ink mfr; ammonium cmpd; saponifying fats & oils; org synth; detergent; household cleanser; food additive; drinking water treatment.
Ammonium nitrate	118.3 G/100 CC OF H ₂ O @ 0 DEG C	0.1 M soln in water: 5.43	NA	Direct application nitrogen fertilizer; chem int for nitrous oxide; component of mixt with fuel oil for indust explosives & blasting agents. Herbicides & insecticides; absorbent for nitrogen oxides; oxidizer in solid rocket propellants; nutrient for antibiotics & yeast; catalyst. Used as a dessicant for cotton.
Ammonium polyphosphate	Sol in water	NA	NA	The largest use of polyphosphoric acid is as an intermediate in the production of high quality liquid fertilizers. May be used as a stabilizer in skimmed sweetened condensed milk and dry milk. Catalytic applications of phosphoric acid, particularly in the form of condensed thermal polyphosphoric acids, make use of its acidic, nonoxidizing, and dehydrating properties. Condensed acids of 82-84% P ₂ O ₅ content are employed as catalysis in the petroleum and chemical industries for alkylation, dehydrogenation, polymerization, and isomerization reactions, including ethylbenzene, gasoline, and plasticizer alcohols.
Ammonium sulfate	76.7g / 100 g water @ 25 deg C	5.5 (0.1 M aq soln)	NA	Food additive. Mfr of ammonia alum; in the mfr of hydrogen sulfide to free it from nitrogen oxides; analytical uses; freezing mixtures; flameproofing fabrics and paper; mfr viscose silk; tanning, galvanizing iron; in fractionation of proteins.

Chemicals	Solubility	pH	Vapor pressure	Uses
Barium sulfate	0.000222 G/100 CC WATER @ 18 DEG C	5% SUSPENSION IN WATER IS NEUTRAL TO LITMUS PAPER	NA	Manufacture photographic papers, artificial ivory, cellophane; filler for rubber, linoleum, oil cloth, polymeric fibers & resins, paper, lithographic inks; as a water coloring pigment for colored paper, in wallpaper; as a size for modifying colors of other pigments, in heavy concrete for radioactive shield. Pigment extender for oil & water based paints; pigment (as component of lithopone) in paint & fabrics, plaster; filler in cosmetics (eg, lipstick); hardening agent for cement.
Calcium chloride	74.5 G/100 CC WATER @ 20 DEG C	NA	NA	Used for antifreeze & refrigerating soln, in fire extinguishers; to preserve wood, stone; mfr ice, glues, cements; fireproofing fabrics; automobile antifreeze mixtures; to melt ice & snow; as coagulant in rubber mfr, as size in admixture with starch paste; in concrete mixes to give quicker initial set & greater strength; freezeproofing of coal & ores; dust control on unpaved roads; sizing & finishing cotton fabrics; as brine for filling inflatable tires on tractors to incr traction.
Calcium phosphate (Calcium Bis(dihydrogen phosphate))	1.8 g/100 cc @ 30 deg C	NA	NA	In fertilizers; acidulant in baking powder & wheat flours; in enameling; mineral supplement for foods & feeds
Calcium hydroxide	1730 mg/l @ 20 deg C	12.4 (AQ SOLN SAT @ 25 DEG C)	NA	In lubricants, drilling fluid, pesticides, fireproofing coatings, water paint; as egg preservative; mfr of paper pulp; in SBR rubber vulcanization; dehairing hides; in water treatment; in mortar, plaster, cement and other binding and paving materials
Calcium sulfate	0.209 G/100 CC WATER AT 30 DEG C	NA	NA	Used in mfr of portland cement; in soil treatment; for mfr of plaster of paris; artificial marble; as white pigment; filler or glaze in paints, enamels, pharmaceuticals, paper, insecticide dusts, in yeast mfr, water treatment, polishing powders; in mfr of sulfuric acid, calcium carbide, ammonium sulfate, porous polymers; tofu

Chemicals	Solubility	pH	Vapor pressure	Uses
Diammonium phosphate	1 g dissolves in 1.7 ml water	About 8	NA	Fireproofing textiles, paper, wood, and vegetable fibers; impregnating lamp wicks; preventing afterglow in matches; flux for soldering tin, copper, brass, and zinc; purifying sugar; in yeast cultures; in dentifrices; in corrosion inhibitors; in fertilizers.
Disodium phosphate	Soluble in 8 parts water	9.1 for 1% aq soln @ 25 deg C	NA	Emulsifier (processed cheese, quick-cook cereals, pharmaceuticals); metal phosphatising/electroplating reagent); pottery glazes/porcelain/enamels; scale inhibitor (boiling water treatment); textile/leather auxiliary; detergents.
Ferric chloride	74.4 G/100 CC @ 0 DEG C	NA	1 MM HG @ 194.0 DEG C	Treatment of sewage and industrial wastes; etching agent for engraving, photography, and printed circuitry; condensation catalyst in Friedel-Crafts reactions; mordant; oxidizing, chlorinating, and condensing agent; disinfectant; pigment; feed additive; water purification.
Ferric sulfate	Slowly sol in water	NA	NA	In preparation of iron alums, other iron salts and pigments; as coagulant in water purification and sewage treatment; in etching aluminum; in pickling stainless steel and copper; as mordant in textile dyeing and calico printing; in soil conditioners; as polymerization catalyst.
Hydrochloric acid	82.3 G/100 CC WATER @ 0 DEG C	2.02 (0.01 N)	3.54X10+4 mm Hg @ 25 deg C	In the production of chlorides; refining ore in the production of tin and tantalum; for the neutralization of basic systems; as laboratory reagent; hydrolyzing of starch and proteins in the preparation of various food products; pickling and cleaning of metal products; as catalyst and solvent in organic synthesis; for oil- and gas-well treatment; in removing scale from boilers and heat-exchange equipment; pharmaceutical aid (acidifier).

Chemicals	Solubility	pH	Vapor pressure	Uses
Magnesium carbonate	0.0106 G/100 CC COLD WATER	NA	NA	Used to prepare high purity magnesium compounds in the paint and printing inks industries as well as in the manufacture of fireproofing, fire-extinguishing, flooring, and polishing compounds and as fillers and smoke suppressants in the plastics and rubber industries; USP grade is used as an additive to table salt to keep it free flowing, a bulking compound in powder formulations, and an antacid.
Magnesium chloride	54.25 G/100 CC WATER @ 20 DEG C	NA	NA	Source of magnesium metal, chem int for magnesium oxychloride for cement; catalyst; flocculating agent; agent in fire extinguishers; agent in textile & paper mfr; component for ceramics; fireproofing agent for wood; component of refrigerating brines
Magnesium sulfate	26 G/100 CC OF WATER AT 0 DEG C	NEUTRAL TO LITMUS	NA	As a cathartic & analgesic in medicine; finishing agent for textiles; as water-correcting agent in brewing indust; component of fireproofing compositions, preservatives, tanning & coagulating agents; int for magnesium trisilicate; component of nickel baths for plating other metals; catalyst support for platinum in sulfuric acid production
Manganese carbonate	Sol in dil acid; insol in water	NA	NA	As pigment ("Manganese White"); drier for varnishes; in feeds
Monoammonium phosphate	1 g dissolves in about 2.5 ml water	pH of 0.2 Molar aq soln: 4.2	NA	As baking powder with sodium bicarbonate; in fermentations (yeast cultures, etc.); fireproofing of paper, wood, fiberboard, etc. Ammonium dihydrogen phosphate used to protect pesticides in spray mixtures prepared with alkaline waters

Chemicals	Solubility	pH	Vapor pressure	Uses
Phosphoric acid	548 G SOL IN 100 CC COLD WATER	1.5 (0.1 N aq soln)	0.0285 torr @ 20 DEG C	Over 90% of the phosphoric acid produced in the United States and worldwide is used for agricultural applications as both fertilizers and animal feed supplements. In the manufacture of superphosphates for fertilizers, other phosphate salts, polyphosphates, detergents. Acid catalyst in making ethylene, purifying hydrogen peroxide. As acidulant and flavor, synergistic antioxidant and sequestrant in food. Pharmaceutic aid (solvent). In dental cements; process engraving; rustproofing of metals before painting; coagulating rubber latex; as analytical reagent.
Potassium carbonate	110.5g in 100g water at 20 deg C	pH= 11.6 (aq soln)	NA	Manufacture soap, glass, pottery, smalts and many potassium salts; in analytical chemistry. Television glass accounts for a substantial portion of the consumption of potassium carbonate because the potassium salt is more compatible with the lead, barium, and strontium oxides contained in these glasses than is sodium carbonate.
Potassium chloride	1 G DISSOLVE S IN 2.8 ML WATER	OF SATURATED AQUEOUS SOLUTION @ 15 DEG C: ABOUT 7	NA	Fertilizer component (primary plant nutrient), chem int in prodn of other potassium salts, medication, photography.
Potassium dihydrogen phosphate	SOL 33 G/100 CC WATER @ 25 DEG C	4.4 - 4.7	NA	In buffers for determination of pH; pharmaceutical aid (buffering agent) Baking powder; nutrient solutions; yeast foods; buffer & sequestrant in foods A widespread use is as a mineral nutrient for fermentation broths. Special liquid fertilizers, buffering systems, paper processing.
Potassium hydroxide	Sol in 0.9 part water	13.5 (0.1 Molar aq soln)	1 MM HG @ 714 DEG C	Food additive; electroplating; photoengraving & lithography; printing inks; in analytical chemistry & in org synth; mfr liq soap; pharmaceutical aid (as alkalizing agent); mordant for woods; absorbing carbon dioxide; mercerizing cotton; paint & varnish removers.

Chemicals	Solubility	pH	Vapor pressure	Uses
Potassium phosphate (monopotassium phosphate)	SOL 33 G/100 CC WATER @ 25 DEG C	pH= 4.4-4.7	NA	A widespread use is as a mineral nutrient for fermentation broths. Special liquid fertilizers, buffering systems, paper processing. Its piezoelectric properties has led to its use in sonar systems and other electronic applications.
Potassium sulfate	1 G DISSOLVE S IN: 8.3 ML WATER	AQ SOLN IS NEUTRAL; PH ABOUT 7	NA	Fertilizer for chloride-sensitive crops (eg, tobacco); accelerator in wallboard (construction industry); agent in mfr of glass; cathartic in human medicine; water-corrective agent for foods (eg, brewery water); setting-expansion control agent for dental materials
Sodium acid pyrophosphate (disodium pyrophosphate)	Sol in water	NA	NA	Chiefly in baking powders. FOOD ACIDULANT. Electroplating; metal cleaning & phosphatizing; drilling muds buffer; sequestrent peptizing agent in cheese & meat products; frozen desserts
Sodium bicarbonate	Solubility in water = 8.7g/100g solution at 20 deg C	0.1 MOLAR SOLUTION @ 25 DEG C: 8.3	NA	Leavening agent in baking powder & food ingredients; component of soaps, detergents & pharmaceuticals; agent in leather tanning, textile mfr, paper mfr, fire extinguishers & mfr of indust & household chems
Sodium bisulfate	Soluble	NA	NA	Monosodium salt of sulfuric acid
Sodium chloride	35.7 g/100 ml of water at 0 deg C	6.7-7.3	1 mm Hg at 865 deg C	In the production of chemicals (sodium hydroxide, soda ash, hydrogen chloride, chlorine, metallic sodium), ceramic glazes, metallurgy, curing hides, food preservative, mineral waters, soap manufacture (salting out), home water softeners, highway deicing, regeneration of ion-exchange resins, photography, food seasoning, herbicide, fire extinguishing, nuclear reactors, mouthwash, medicine (heat exhaustion), salting out dyestuffs, supercooled solutions.

Chemicals	Solubility	pH	Vapor pressure	Uses
Sodium dihydrogen phosphate	4.87X10 ⁺⁵ mg/l @ 25 deg C	pH of 0.1 molar aq soln at 25 deg C: 4.5	NA	In baking powders; in boiler water treatment; as dry acidulant and sequestrant for foods. Buffering agent (electroplating baths); acidulant (processed meats, egg products, powdered drinks); builder (industrial cleaning formulations); metal phosphatising reagent; mineral supplement; softening/conditioning agent (boiler water treatment; textile dyeing/printing auxiliary).
Sodium hexa-metaphosphate	SOL IN WATER	NA	NA	AKA Calgon. Softening water without precipitate formation, as in dyeing, laundering, textile processing, and washing operations; corrosion inhibitor in de-icing salt preparations; frozen desserts; pretanning hides in the manufacture of leather; dispersing clays and pigments; threshold treatment for scale; and corrosion prevention.
Sodium hydroxide	1 g dissolves in 0.9 ml water	0.05% WT/WT SOLN ABOUT 12	1 mm Hg @ 739 deg C	NaOH solutions are used to neutralize acids and make sodium salts, e.g., in petroleum refining to remove sulfuric and organic acids; to treat cellulose in making viscose rayon and cellophane; in reclaiming rubber to dissolve out the fabric; in making plastics to dissolve casein. NaOH solns hydrolyze fats and form soaps; they precipitate alkaloids (bases) and most metals (as hydroxides) from water solns of their salts. Pharmaceutic aid (alkalizer).
Sodium nitrate	92.1 G/100 CC WATER AT 25 DEG C	AQ SOLN IS NEUTRAL	NA	More than half of the sodium nitrate produced worldwide is used as a fertilizer for crops such as cotton, tobacco, and vegetables...in the U.S. it is of minor importance compared to other fertilizers. The major industrial use is in the explosives industry. Oxidizer & fluxing agent in the mfr of glass & enamels; component of charcoal briquettes, heat-transfer salt; curing agent & preservative in meats; chem for recovery of tin from scrap; oxidizing agent (eg, in metal coloring solns); chem int (eg, for potassium nitrate)

Chemicals	Solubility	pH	Vapor pressure	Uses
Sodium nitrite	SOL IN 1.5 PARTS COLD WATER	pH ABOUT 9	NA	Diazotization (by reaction with hydrochloric acid to form nitrous acid), rubber accelerators, color fixative and preservative in cured meats, meat products, fish; pharmaceuticals, photographic and analytical reagent, dye manufacture.
Sodium sulfate	SOL IN ABOUT 3.6 PARTS WATER	NA	NA	Tanning; pharmaceuticals; freezing mixtures; laboratory reagent; food additive
Sodium sulfite	Sol in 3.2 parts water			Chiefly in photographic developers and instead of "hypo" for fixing prints; bleaching wool, straw, silk; generating SO ₂ ; as reducer in mfr dyes; silvering glass; removing traces of Cl in bleached textiles and paper; preserving meat, egg yolks, etc. Dietary supplement; antioxidant.
Sodium tripolyphosphate (pentasodium tripolyphosphate)	20g/100 ml at 25 deg C	1% soln @ 25 deg C = 9.7-9.8	NA	One of the most widely used and most effective builder in heavy-duty fabric washing compositions. Because of its high sequestration power, it also finds extensive application in automatic dish-washing detergents. It forms stable hydrates and thus aids in the manufacture of crisp spray-dried laundry powders. Texturizer in food. Phosphorus source for cattle.
Sulfuric acid	SOL IN WATER	0.01 N soln = 2.1	5.93X10 ⁻⁵ mm Hg at 25 deg C	Used in fertilizers, chemicals, dyes and pigments, etchant, alkylation catalyst, electroplating baths, iron and steel, rayon and film, industrial explosives, lab reagent, nonferrous metallurgy. Used as herbicide.
Sulfurous acid	NA	NA	NA	NA Forms from sulfur dioxide
Tetrapotassium pyrophosphate	NA	NA	NA	NA See tetrasodium pyrophosphate.
Tetrasodium pyrophosphate	6.7 G/100 ML @ 25 DEG C	10.2 (1% SOLN)	NA	Indust & institutional detergent builder; in water treatment; in household laundry detergents; in processed cheeses; in other food applications; in textile & clay processing, elastomers, & paper processing

Chemicals	Solubility	pH	Vapor pressure	Uses
Tricalcium phosphate	2.5 mg/100 g water at 25 deg C	NA	NA	Manuf of fertilizers, H ₃ PO ₄ and P compds; manuf milk-glass, polishing and dental powders, porcelains, pottery; enameling; clarifying sugar syrups; in animal feeds; as noncaking agent; in the textile industry. Stabilizer for plastics; in meat tenderizers; in food as buffer
Trisodium phosphate	8.8 G SOL IN 100 CC WATER	pH of 0.1% soln: 11.5	NA	Removing insecticide residues from fruit & inhibiting mold. In photographic developers; clarifying sugar; removing boiler scale, softening water; manufacture of paper; laundering; tanning leather; in detergent mixture. In dairy substitutes (milk-based pudding, sour cream, cheese).
Zinc sulfate	101 g/100 g water @ 70 deg C	NA	NA	Zinc sulfate & hydrated lime, 8 lb of each to 100 gal of water, are used to prepare spray called zinc-lime which is the zinc equivalent of bordeaux mixt. Zinc-lime is used extensively for control of bacterial spot disease of peaches. Depressant in froth flotation, eg, for lead-zinc ores; component of spinning bath in mfr of rayon; chem int for mfr of the pigment lithopone, of carbamate fungicides, eg, zineb, for mfr of zinc metal, for mfr of other zinc compounds, eg, zinc stearate; component of zinc plating baths; chemical for water treatment; component of cosmetics, eg, skin fresheners; reagent for paper bleaching, in mfr of glue; accelerating agent in dental impression material; agent in textile dyeing & printing; preservative for wood & hides; fireproofing agent

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